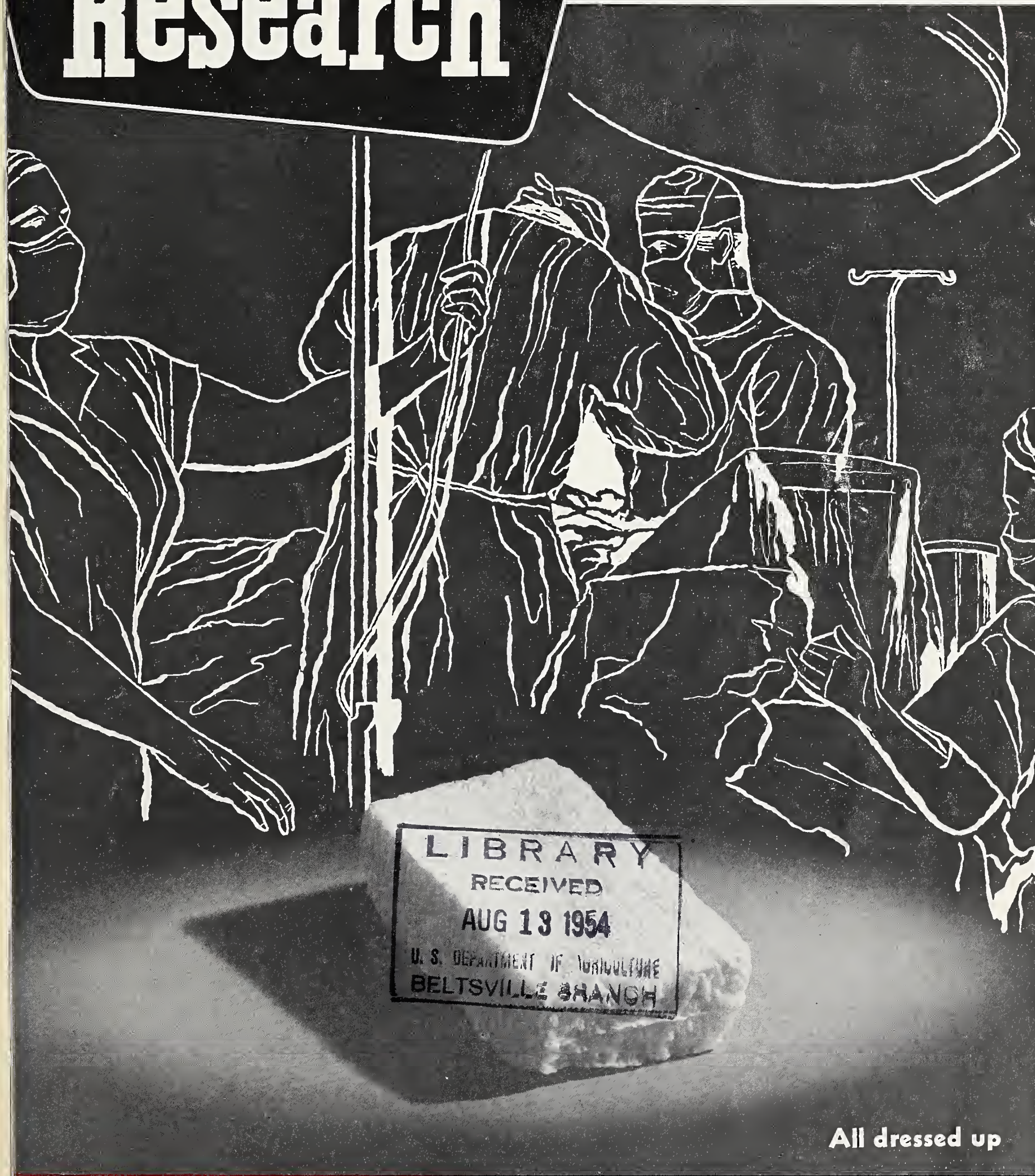
AGRICULTURAL Research

AUGUST 1954



All dressed up

AGRICULTURAL
Research

VOL. 3—AUGUST 1954—NO. 2

JOSEPH F. SILBAUGH—MANAGING EDITOR

TOO MUCH?

In the 1930's, some people who were greatly concerned with crop surpluses offered an amazing solution: *stop plant research!*

Fortunately, this suggestion wasn't taken seriously. Otherwise, we might have had trouble filling our expanding food needs, to say nothing of meeting such emergencies as World War II and new plant diseases.

Viewing today's surpluses, we would do well to keep in mind that our population is increasing more rapidly than ever. And we can't afford to be caught without a cushion for possible future emergencies. Providing for these needs is, of course, a major aim of research.

But the fact is that research also helps cushion the impact of *surpluses* and, eventually, should actually do much to prevent them.

Research can find ways of converting *seasonal* surpluses of *perishable* commodities into stable, palatable, easy-to-use forms that are preserved and made available throughout the year (frozen concentrated orange juice, for example). Research can tackle *annual* surpluses of *stable* commodities, improving their properties, encouraging extra consumption, developing new outlets (as with fats and oils).

Research also helps by raising efficiency and lowering production costs. It brings economies in transportation, storage, and handling thus helping reduce the price spread between producers and consumers.

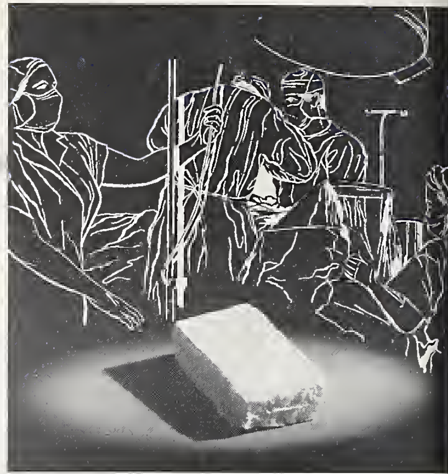
Looking *behind* surpluses, we find this country is never satisfied with less than *enough* food and fiber. Here we run into production hazards—diseases, drought, insects, and the like. This means that to have enough at *all* times, we are *sometimes* going to grow too much.

Now, we can't hope to eliminate this problem entirely. But crops with greater resistance, improved supplies and equipment, more effective conservation of soil and water, better business management practices—such research developments as these can reduce the threat of loss. By holding crop hazards to a minimum, we can fit production to our needs far more accurately—that is, with less margin for safety.

Furthermore, as Cotton Belt diversification shows, research can help farmers adjust their operations to the demands of the market.

Research has shown us how to *produce* abundantly. It's also showing us how to *stabilize* this abundance and to *use* it more efficiently.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture



STARCH SPONGE, long known to scientists, has become a remarkable surgical dressing and a versatile food product. These developments have now led to commercial production (p. 6).

Contents

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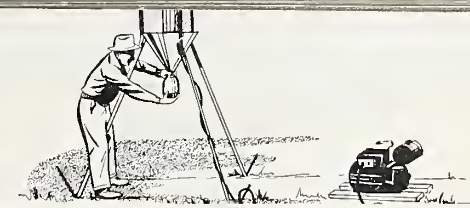
Light traps



SCOUT INSECT ENEMIES

ENTOMOLOGISTS got early warnings this year of invasions by some of our worst insect enemies.

These warnings were provided by electric light traps, used not as a means of control, but as an army uses scouts—that is, to detect the presence and approximate numbers of the enemy so effective and properly timed counterattacks can be made.

About 50 traps are being run experimentally this year by USDA–ARS and State scientists, cooperating in the fight against crop-destroying insects. The traps are largely of the "black light" type—so called because the rays are barely visible to the human eye. This near-ultra-violet radiation, for unknown reasons, attracts many night-flyers.

The light traps were used in southern States early in the season to supplement other means of detecting the presence of insect pests. In Louisiana, for example, moths of cutworms and armyworms were taken in February, indicating that emergence was underway. Three weeks later there was a moderately heavy infestation of these insects in wheat and oats and a light infestation in clover pasture sod. Shortly following that, the light traps lured moths of the highly destructive cotton bollworm for the first time of the season.

Northward, the first armyworm moths were taken in Tennessee late in March. Moths of forage loopers, yellow striped armyworms, seed-corn beetles, and seed-corn maggot flies followed. By mid-April, thanks to the early warning, control measures were in readiness for a fairly serious infestation of armyworms.

LURED TO THEIR DOOM by experimental mercury-vapor light trap, night-flying insects made the curved paths in this sustained-exposure photo. Lamps used in such traps supply not only radiation visible to the human eye but also near-ultraviolet radiation ("black light"), believed to be attractive to insects. This trap is in use at the Purdue experiment station.

During April, the light traps picked up tobacco budworm moths and sugarcane beetles in Louisiana, and tobacco hornworm moths in Florida late the same month. Early in May, armyworm moths were captured in Iowa, and moths of cutworms and armyworms in Kentucky, Missouri, South Carolina, and Pennsylvania.

The light traps now in use, designed by ARS engineers only a few years ago, were made possible by the development of the fluorescent lamp. In such lamps, the spectral character of the energy released can be controlled by coating the inner surface of the glass tube with various phosphorescent materials. Thus, they can be made to provide the radiation in the near-ultraviolet range, which has so far proved to be the most attractive to night-flying insects.

Agricultural engineer T. E. Hienton, head of farm electrification research, believes that light traps hold promise of becoming an important weapon for supplemental use in detecting the presence as well as the numbers of certain insect pests.

"Since experiments with the black-light began in 1952," he says, "it has shown merit in detecting the presence of the pink bollworm—in some instances in areas where it wasn't previously known to exist. We know also that the traps have had some measure of success in detecting insects that infest stored grain as well as those that attack field crops. This year's research will be checked against results of previous years. In this way, we hope to determine the present degree of attractiveness and to plan improvements of the traps." ☆

What's the right time to cull?

Constant culling of dairy herds is an essential part of good management—and frequently the difference between profit and loss.

Makeup of the average dairy herd changes about one-fifth each year, says USDA–ARS agricultural economist M. S. Parsons, who has compiled cost-study results from various dairying regions of the country.

The culling percentage may be up or down the scale, depending on a variety of conditions. This year, for example, culling could go beyond the 20-percent average, to the general advantage of the Nation's dairy industry. This would help eliminate low-producers—border-line cows that are barely paying their way.

Most dairymen attempt to cull only cows that are unprofitable. This is no problem if cows are to be culled for such reasons as poor breeding qualities, undesirable physical characteristics, or disease. But a dairyman needs to give considerably more thought before he consigns a cow to the butcher's block solely on the basis of low production.

Let's assume the dairyman keeps records and thus knows the milk and butterfat output and feed intake of each cow in his herd.

Take Cow A. Although her feed intake hasn't changed, her production rate has fallen off to 4,000 pounds of milk a year. This will gross the dairyman about $180. Her out-of-pocket cost runs about $170 to $180.

Obviously, she's not a money-maker. The dairyman can sell her for beef without changing the net income he receives from his herd.

But why cull her now? She's old—yet she's a good breeder. Her calves have a good record in the herd. That makes her worth keeping until she has calved once more, especially since her maintenance cost will be small so long as pasture is available. So let's cull her in the fall.

What about Cow B? She's producing about 6,000 pounds during the milking year—close to average in most dairy States. This production would gross approximately $270.

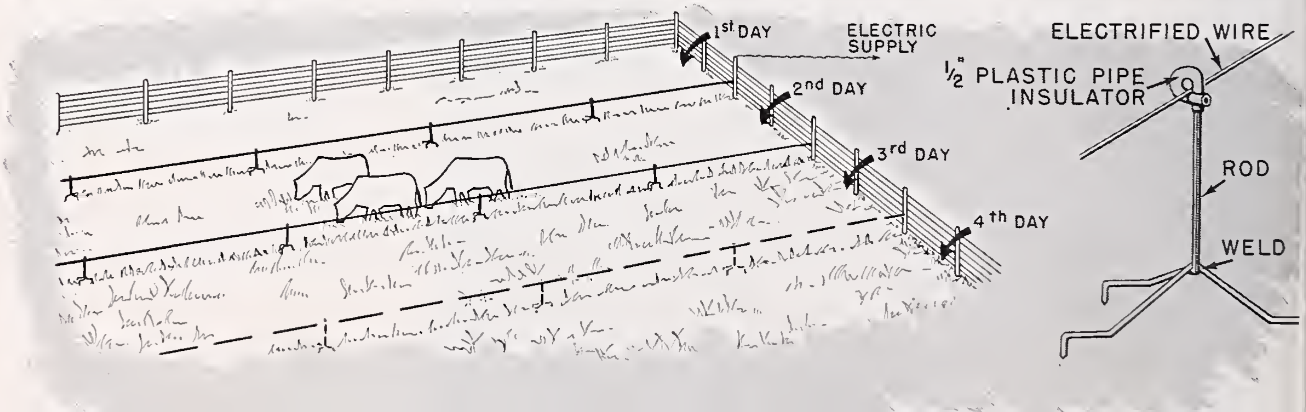
Perhaps the first step is to consider replacing her with a better cow—say an 8,000-pound producer. This means finding a better producer and getting a fair beef price for Cow B. If this can be done, fine.

COMPARING THREE TYPES OF Intensive

Three methods of intensive grazing for dairy cattle are under study by USDA–ARS scientists at the Agricultural Research Center, Beltsville, Md.: (1) *Strip grazing*—cows are confined to a fresh strip of pasture each day by portable electric fences. (2) *Rotation grazing*—cows graze a large pasture for 6 to 10 days. (3) *Soiling*—supply of forage is cut fresh in a pasture daily and taken to the cows.

Using Ladino-orchard grass- pasture, agronomist Mason Hein and dairy nutritionist C. H. Gordon are comparing the three practices on the

NEW PORTABLE TRIPOD POST for electric fences simplifies strip-grazing. (For ordinary electric fence, posts must be driven into the ground; this means extra time and work in moving to a new location.) New post can be homemade: forming tripod from 3/8-inch iron rod is a simple bending and welding job that many farmers can do for themselves, and the insulation is merely a length of plastic (polyethylene) tubing as used in farm water pipes. Wire to carry the electric charge needn't be any heavier than 18-gauge if copper-coated steel is used, but a somewhat greater weight is recommended in aluminum wire. With tripod posts spaced about 30 feet apart and the charged wire securely anchored at each end to posts of a permanent fence, the portable fence is little disturbed by cattle or winds.



Otherwise, the dairyman must decide whether it will pay to cull Cow B without replacing her. If he does, he will cut gross income by about \$270, expenses by about \$200.

This would mean selling (or not buying) the hay and grain normally eaten by Cow B—but it allows no return for the silage or pasture that the dairyman is actually selling through the milk this cow produces. Most important is the fact that he will cut his net income by \$70, even if he sells at going prices the grain and hay the cow would have used.

Culling might better wait until late summer or early fall, after Cow B has done her part to turn the dairyman's good pasture into milk.

In any case, a dairyman who keeps records of production and feed intake is in better position to cull intelligently than one who has no records. Without them, he must resort to rules of thumb. But records give him a sound basis for decisions. ☆

Grazing

basis of milk yields and other effects on the cows; carrying capacity of the pastures; total and seasonal yields; and labor and time involved.

Agricultural engineer L. E. Campbell has aided the strip-grazing experiments by devising a *portable* electric fencepost—necessary equipment for dairy farmers who use this practice (see illustration).

Strip grazing is relatively new. Tried in California and Wisconsin, it has raised milk production by 50 to 100 percent per acre of pasture. Cows get fresh forage daily and have less chance to damage or foul the pasture. There's also less possibility of bloat: spot grazing on legumes alone is practically eliminated, with as many as 30 to 60 cows using an acre of pasture under good conditions. ☆

FOOD and HOME

Where CHICKEN gets its FLAVOR

The alluring flavor that makes chicken so popular (and so disappointing when a bird has little of it) has been traced to its source by USDA–ARS chemists.

It's the *meat* of the bird that holds greatest riches of flavor, the research shows. *Bone* and *skin* yield minor amounts, *fat* almost none.

Another finding: much flavor appears to be lost when raw chicken is soaked in ice water or cold water. This point's important to industry since chilling in slush ice and thawing in cold water are common.

In prospect is help for processors, shippers, and cooks on conserving the fullest possible flavor in broilers, canned chicken, and other forms of this food. But conclusions must await further work, needed to show the effects on flavor of other variables in poultry processing.

E. L. Pippen, Agnes A. Campbell, and Iva V. Streeter of the Western Regional Research Laboratory are the scientific team engaged in pinning down the origin of chicken flavor and ways in which it can be lost on the bird's trip to the table.

To compare flavor sources, the researchers made much use of broth prepared from portions of the chicken and served for judging unseasoned, hot, and clear (after all fat was removed). Broth could be diluted or concentrated, whereas meat itself would be difficult, or even impossible, to use similarly. The judges tasted and whiffed broth samples, rating taste and aroma on a flavor-strength scale that ranged from 10 points (top score) to zero (no flavor).

From these preliminary experiments, the scientists learned that:

1. Broth from fat-rich and fat-poor chickens generally tasted much the same. And fat was a poor solvent for catching flavors; judges gave fat skimmed from broth a rating of less than 1 in their 10-pound scale. But fat did help flavor-appeal by giving broth a stronger aroma.

2. Light meat and dark meat were about equally good as flavor carriers when broth made of each separately was tasted and judged.

3. Combining bones, skin, and meat didn't seem to produce any teamwork toward superior flavor. In fact, broth from the mixture rated about a point lower than all-meat broth.

4. Chicken meat cut up, soaked in cold water, and squeezed free of water made a faint-flavored broth. But putting the extracted water into the broth restored almost all the flavor that had been lost.

The scientists stress that their experiments on the effects of soaking half-carcasses in ice water were done under laboratory conditions, using birds previously frozen. Work remains to be done on unfrozen birds, fresh-slaughtered, more nearly as in commercial ice-water chilling.

The origin of chicken flavor is proving similar to the flavor source of beef, which researchers experimentally traced some years ago. ☆

WE REDISCOVERED

Starch Sponge

STARCH sponge—known to scientists a century ago—had been somewhat forgotten till USDA-ARS chemists took a new look at it with an eye to industrial application.

Two seemingly unrelated products—an absorbable surgical dressing and a new food specialty—came out of this research at the Northern Regional Research Laboratory.

To prepare the sponge, a cooked 5-percent paste of commercial starch—made from corn, wheat, or other sources—is cooled to from 28° to 3° F., thawed, and pressed to remove most of the free water. When pressure is released, the resulting sponge expands to assume the form of the mold in which it was originally cast.

Clinical evaluation of starch sponge as an absorbable surgical dressing to control bleeding has given such satisfactory evidence of its safety and usefulness that the sponge is now in commercial production. Its outstanding advantage is that it *completely* dissolves in blood, body fluids, or tissues; there's no need to reopen a wound or incision to remove the sponge. Body enzymes break the starch down to simple sugars that are rapidly absorbed and used.

Ability of the sponge to control bleeding is due to its great number of cell-like spaces, which expose a large surface area to the shed blood; to mechanical obstruction of the blood vessels as the sponge swells; and to the breakdown of sugar products—released as the sponge dissolves—which cause clumping of red corpuscles and speed clotting.

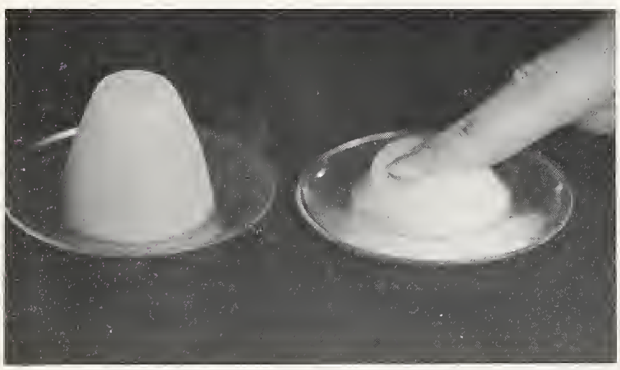
Antibiotics or other substances can be added to the paste before it's converted to sponge form, or absorbed by the dry sponge before introduction into a deep wound or incision.

Formed on a gauze backing, thin layers of the sponge can be used for wet dressings—for example, on burns. Tissue forming around parts of the dressing needn't be cut since the sponge is absorbed. This avoids considerable pain to the patient.

Dry sponge has a variety of possibilities in foods. It can be used to make a new type of crunch candy. Shredded, it can be used like coconut and nutmeats; ground, it can be used in candy coatings or bars to improve their texture and ability to withstand extreme temperatures.

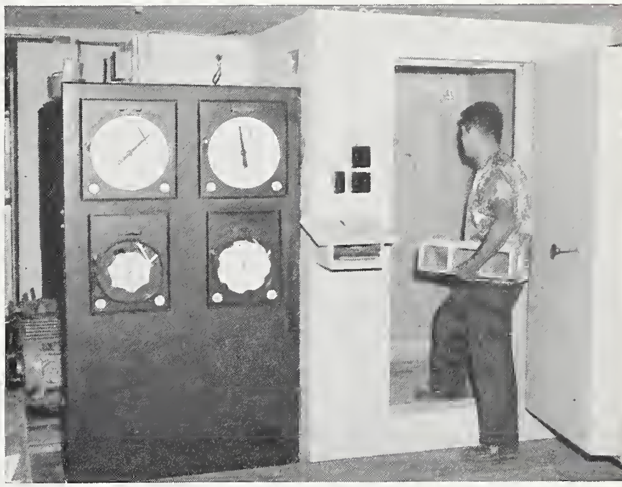
The sponge can be prepared from starch alone or with the inclusion of other materials. Flavoring extracts, chocolate, soya or wheat flours, vitamin preparations, and fruit, vegetable, or meat concentrates may be added to the starch paste before freezing. The resulting sponges can be used as such or further treated—for example, by coating them with chocolate.

Thus fortified, starch sponge—a concentrated carbohydrate—also has possibilities in emergency rations. ☆



STARCH SPONGE is hard and brittle—but it rapidly absorbs 15 times its weight of a water solution, becoming soft, pliable, compressible. It is firm enough to hold this liquid in gentle handling. For surgical and dental dressings, sponge is made up as blocks and cones (right, top) and powder. Absorbed by the body, it needn't be removed. Starch sponge also shows promise for use in many food products, including chocolate candy (right, bottom).

A step ahead of the ORIENTAL FRUIT FLY



BIOCLIMATIC CABINETS enable scientists *in Hawaii* to study oriental fruit fly's development under *mainland* conditions without risking accidental introduction here. Hour-by-hour temperatures and humidities of U. S. areas are reproduced by the cabinets. Entrance through anteroom (above) prevents influencing inside climate. Cabinets resemble walk-in refrigerators, contain food, water, ultraviolet and infrared lamps for sun-like heat, light. (Adult fly punctures fruit in depositing eggs; maggots hatch, feed on fruit and cause decay. Punctures provide easy entry for diseases and spoil appearance of fruit.)

FRUIT growers hate to think what could happen if the oriental fruit fly ever slips past border guards to establish itself in this country.

So far, the fly has been blocked from the United States by quarantines and inspection. But it constantly threatens invasion from the many areas in which it's established, particularly Hawaii. The fly is a hardy traveler, capable of moving great distances in cargoes of fruit.

This tiny, clear-winged insect attacks more than a hundred kinds of plants. It became a principal destroyer of many economic varieties of fruit grown in Hawaii—but fortunately *not* of the important pineapple—within 2 years after its discovery there in 1946.

Planning our defense in case the oriental fruit fly does invade depends largely on finding out just *where* we'll have to fight it—where the insect can best survive and build up infestations in this country.

Entomologists studying the fly's reaction to various *simulated* U. S. climates (see picture) have thus far pinpointed these areas of the extreme South with winters potentially favorable to oriental fruit fly development or survival: southern Florida, the lower delta area in Louisiana, and along a coastal region and in the lower Rio Grande Valley in southern Texas. Most favorable winters are those where the average temperatures fall below 57° F. for only 2 months or less.

A marginal or "danger" zone where this fly might survive the winter includes a fringe along northern Florida, southern Texas, Louisiana, Mississippi, Alabama, and Georgia, the lower Colorado River and Imperial Valley areas in California, and part of southwest Arizona.

Exceptionally hot, dry, summer weather, with daily temperatures above 100° F., is hard on the oriental fruit fly. The simulated climates of Riverside, Fresno, and El Centro, Calif., Tempe, Ariz., and Weslaco, Tex., all had summer periods that were too hot for normal survival, reproduction, and development.

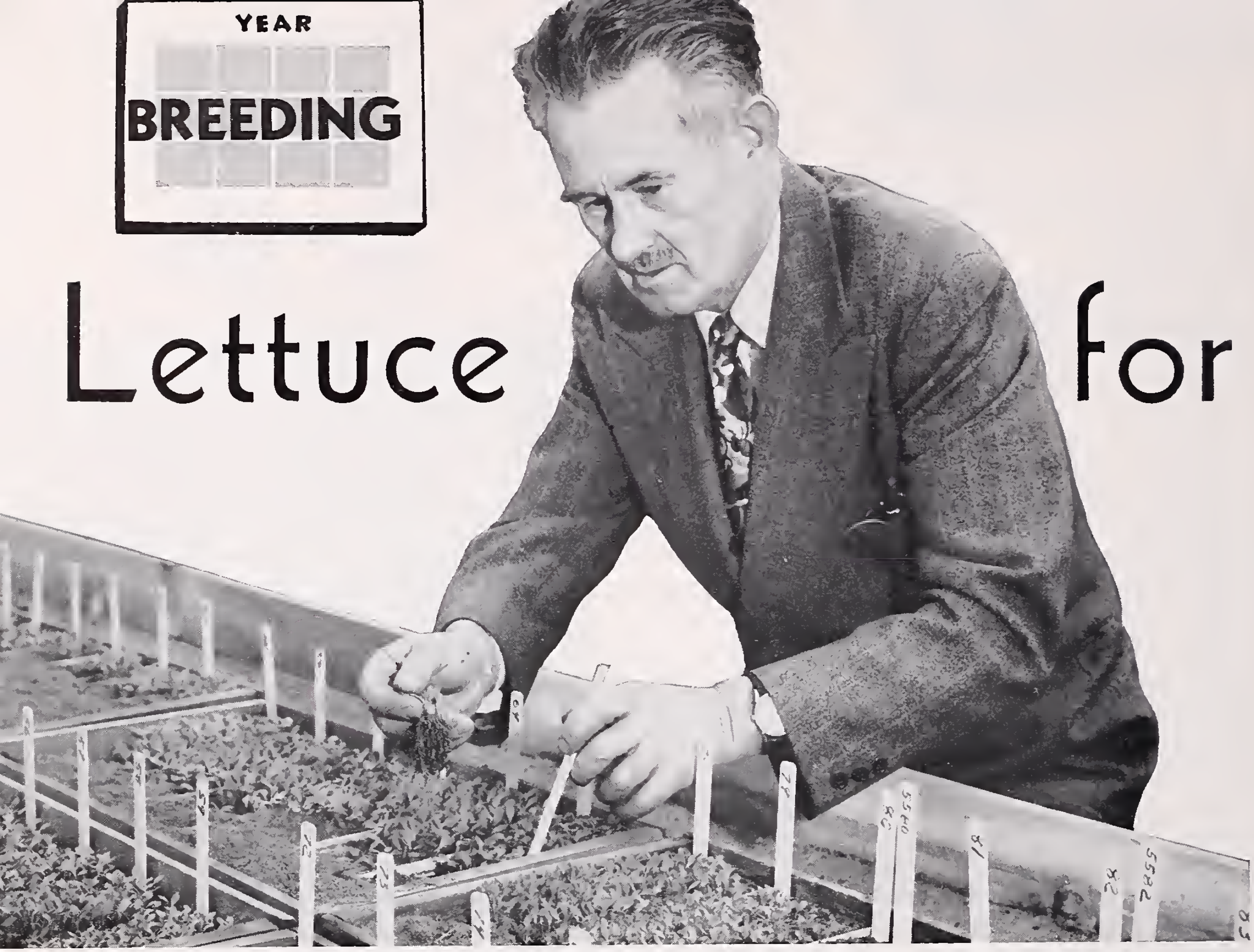
The melon fly and Mediterranean fruit fly, both serious pests of fruit in Hawaii, have also long threatened the U. S. mainland. These insects may find conditions in most of Florida and at some Gulf of Mexico coastal sites favorable for year-round development, but hot, dry weather affects *them* severely too. The melon fly was able to infest fruit periodically during a simulated El Centro winter, and occasional adults were able to develop and emerge during a Fallbrook (Calif.) winter.

These climate studies, cooperative between USDA-ARS and the California experiment station, have tested the flies' reaction to the climates of 18 typical fruit-growing regions of the U. S. thus far.

Entomologists P. S. Messenger, N. E. Flitters, and associates plan further study of the effects of hot weather, as well as the availability of food for year-round development of fruit flies in these zones. ☆

YEAR BREEDING

Lettuce for t



1. Hopes of new year in lettuce breeding rest on this generation from seed produced in last year's breeding work. Plants in a group have same pair of parents. Geneticist R. C. Thompson holds part of a representative sample of a hybrid line to be grown and studied.

WHEN Nature invented head lettuce she gave the West an inside track for producing it. The crop likes cool weather and short days found in California's fog-shrouded coastal valleys, Arizona's winter growing season, and high Rocky Mountain valleys.

The East's summer heat and the North's long summer daylight cause today's head lettuces to bolt—produce seed stalks early, rather than firm up with leaves. Heat also favors diseases. But USDA-ARS plant breeder R. C. Thompson and assistant W. F. Kosar are trying to coax Nature to create better head lettuce for the East, where most of it is eaten.

Disease resistance is being sought in all breeding lines. Major diseases are tip burn and midrib breakdown (for both of which high resistance has been developed), mosaic (for which high tolerance but no immunity has been developed), aster yellows, big vein, sclerotiniosis, and bottom rot. No sources of resistance have been discovered for the latter four diseases, one of which (aster yellows) has become extremely destructive within the past 15 years.

The scientists are selecting breeding lines for firmness of head, but a smaller head than the West grows. In the East there will be a shorter haul, less damage, and less need to discard outer leaves.

Quality is another major consideration. Consumers insist that lettuce be free of bitterness and off-odors. Some lettuces, especially wild strains, have flavors and odors unacceptable to consumers. Lettuce should have some flavor, however—preferably a little sweetness. Crisp, tender texture is also sought.

This difficult, time-consuming program is beginning to pay off in lines of head lettuce combining slowness of bolting, superior quality, and resistance to some diseases. Within a few years, when plant type has been made more uniform, the East will be able to grow more high-quality head lettuce, just as it's now growing leaf lettuce developed in this program. ☆

e East

2. Plants are set out, one per paper cup. Plants taken at random represent entire population. Each hybrid group, labeled, stays together in greenhouse to the 12-leaf stage.

3. Strong plants are set out in field, cup and all (roots penetrate cup). Progeny of a common parentage go together in row. Crop's carefully tended; any plant may be the prize.

. Growing hybrids are inspected often for
esired features—form, size, color, lack of
pburn or disease. All superior plants are
arked—serial number, plant features shown.

5. Firm, disease-free, well-colored heads are stripped so seed stems can grow free of rotting leaves. Elongated stem (shows early bolt) or internal disease rules out plant.

6. Chosen plants are potted, identity label affixed, and moved to greenhouse. Detailed records of plants are studied to find out whether further crossing may be necessary.

. W. F. Kosar washes the pollen from flower
uster intended as female parent in cross—
ill apply chosen pollen. A plant may serve
many crosses as the male or female parent.

8. Seed head of each field selection is harvested separately and bagged for drying. Numbered tag, transferred to the bag, is key to the hybrid's background and plant features.

9. Seed is rubbed out, cleaned in sieve over blower. Off-color seeds or mixtures in lot are picked out—others packaged, marked with serial number, filed for planting next year.

LOST:

half our legume seed

MOST of this country's legume seed producers are harvesting only about half a crop.

Oregon crimson clover growers and Michigan alsike clover and alfalfa growers lose 60 percent of their seed crops. Alabama crimson clover fields with a possible 1,000 pounds of seed per acre often yield less than 300. In South Carolina, 40 to 50 percent losses of crimson clover and lespedeza are common. Why?

The natural tendency of seeds to shatter from the pods as the plant matures, coupled with pelting rains in humid areas and strong winds in dry areas, is one big reason. Rough terrain, weeds, and lack of uniform plant growth also play a part.

Second big reason is growers' dependence on standard grain-harvesting equipment—combines, windrowers, swathers—to harvest the smaller, lighter legume seeds (they weigh only $\frac{1}{10}$ to $\frac{1}{30}$ as much grain). Pointing up this problem are tests at the USDA-ARS Agricultural Research Center, Beltsville, Md., where perfectly cured red clover was threshed by a carefully adjusted stationary combine—with a loss of more than a third of the seed!

Half our crimson clover and lespedeza seed is produced in the humid Southeast. Here, ARS agricultural engineer J. H. Park is cooperating with the South Carolina experiment station to find ways of reducing seed loss traceable to equipment.

Preliminary results show *direct* combining is usually better than combining from windrow or swath. Extra handling causes added seed shattering, and there's danger that rain will knock seed out of the pods when a crop lies curing in the field.

Use of angle-bar cylinders, rather than the rasp-bar or spike-tooth type, gave the biggest combine improvement for crimson clover harvest.

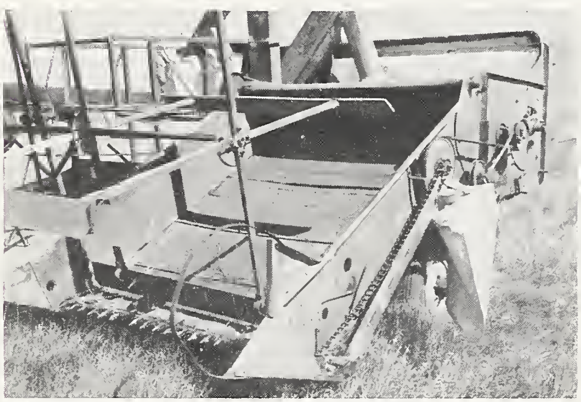
The tests indicated that in the humid Southeast, clearance between combine cylinder and concave (where the threshing is done) should be as small as practicable to thresh out the greatest number of seeds. And the cylinder should rotate at as high a speed as practicable. High cylinder speeds increased seed damage, but this loss was overshadowed by the extra seed harvested.

Park also found that combines should travel as slowly as possible. A half more seed was harvested at 1.5 miles per hour than at 3 m. p. h.

Seed losses have concerned California experiment station scientists, too. Improvement in harvesting methods, based on their research findings, has boosted average germination of harvested alfalfa seed 11 percent (from 84 to 95) in the last 3 years by reducing cylinder damage. The result is a saving of at least 100 pounds of seed per acre.

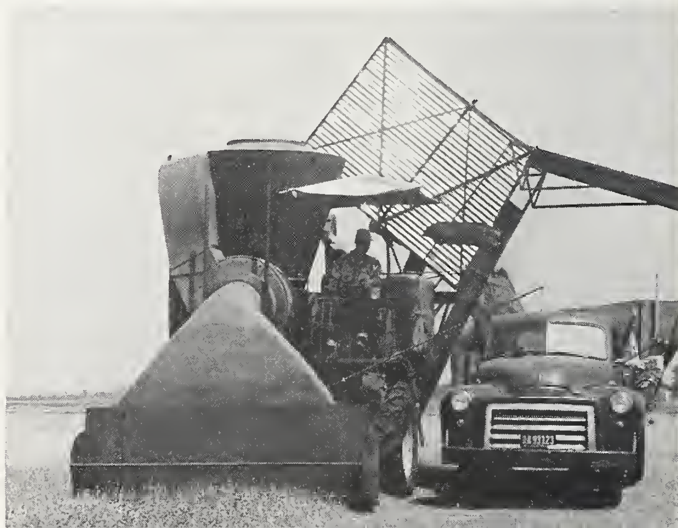
Machine adjustment has been a major factor in seed-saving in that State. Tests have established optimum cylinder speeds for several legumes in order to reduce threshing loss, yet avoid excessive damage under the local dry operating conditions.

In combining alfalfa, red clover, and ladino clover, use of flax rolls



SEED-SAVER developed by South Carolina grower is based on an auger (not visible here) installed behind the cutting bar of his combine. This auger carries loose seed, pods to the chain-driven elevator, which takes seed up to the sack.

VACUUM-SWEEPER combine adaptation custom-harvests tiny Ladino clover seed in California. Clover is sucked directly from cutter bar into threshing cylinders. Threshed crop material is collected in box (here being emptied into truck), will be rethreshed to save much seed.



ahead of the cylinder resulted in more seed because the rolls retarded the flow of straw through the combine. This, in turn, allowed a more effective combing, seed-removing action on plants by the cylinder.

A V-bar cylinder was superior to other types for red clover.

Seed loss can also be cut in picking up plants from windrow or swath by running the combine's pick-up mechanism 10 to 15 percent faster than the rate of travel. Belt-type pick-ups proved best because the belts tended to carry loose pods and shattered seed into the combine.

Results of rate-of-travel tests under dry California conditions were similar to those of Park. Some growers have now equipped their self-propelled combines with speed-reduction gears that can cut forward speed to less than a half mile an hour.

Controlling the rate of crop pick-up (by regulating the forward speed of the combine) also helps prevent overloading the machine's cleaning shoe with chaff and bits of straw. This shoe, which separates seeds and grain from chaff, handles only 5 to 10 percent of the total combine intake in harvesting small grain; but with alfalfa seed, the shoe handles half or more of the load, thus reducing the combine's total capacity.

On the basis of research, California growers were advised to install a canvas or metal pan under the combine to trap seed that leaks out.

Now gaining prominence as legume seed-savers in all areas of the country are pre-harvest defoliating sprays that kill top growth and speed curing. By defoliating, a grower can combine seed directly without risking wind or rain damage in windrow or swath. He can also combine at higher moisture content. Although this may require drying the seed, moisture counteracts shattering, cuts mechanical damage to the seed, and reduces the chaffing that overloads the cleaning shoe. ☆

3-way is the easy way with CASTORBEAN HYBRIDS

Three-way castorbean hybrids soon may become a commercial reality through new ARS plant-breeding methods, eliminating a costly, tedious hand operation in seed production.

Key to the labor-saving 3-way cross is male sterility—development of flowers that bear only female organs—in two new crosses. Furthermore, this all-female characteristic has been found in other castorbean crosses, making it probable that within a few years plant breeders will be able to introduce an even wider range of genetic factors in hybrids of this crop (see AGR. RES., June 1954, sorghum, July 1954, onions).

Castorbean production is now based on single-cross hybrid seed, only a few years old (AGR. RES., July 1953, July 1954). In producing such seed, as many as six hand roguings are necessary to get rid of normal-flowering plants (those with both male and female organs) and assure fertilization of the female parent by pollen from a selected pollinator line only. But the extra crossing in a contemplated 3-way cross largely obviates roguing. The reason is in the castorbean's complex nature:

Normally, the castorbean has pistillate or female-type blossoms in the upper 30 to 50 percent of the raceme or flower cluster and pollen-bearing male blossoms on the lower 50 to 70 percent. But there are *variations*: for example, the Nebraska 145–4 line with only female flowers on about half of the plants. The other half have normal clusters (that is, with both male and female blossoms).

The Nebraska 145–4 line is the mother plant in commercial production of F_1 single-cross hybrid castorbean seed that farmers now use. The *normal* flower clusters must be destroyed to prevent self-pollination. Thus, only the all-female-flowered plants are used in hybridizing.

Recently, ARS agronomists L. H. Zimmerman and W. Parkey discovered that this female-flowered Nebraska 145–4 crossed with Brazillian 330 produces 100 percent female seedlings. And crossing female-flowered Nebraska 145–4 with USDA 49 produces only a trace of pollen.

So the agronomists suggest that one of these new F_1 crosses—rather than Nebraska 145–4 itself—be used as an all-female parent in producing the final seed crop for farmers. Thus, instead of roguing *all* the final seed crop, seed growers need rogue only enough acreage for *seed to plant this final crop*. And one acre of the semi-final crop will produce enough seed for 50 to 100 acres.

The new procedure would provide farmers with a 3-way hybrid, rather than a 2-way single cross. Such 3-way hybrids are under test for yield and other characteristics.

Other all-female lines are being tested in various crosses to see if the femaleness carries over to F_1 descendants. If it does, seed producers will have greatly increased possibilities for combining desirable genetic factors, such as seed productivity, oil yield, disease and shatter resistance, geographic adaptability, and uniform plant height for combining. ☆

TIMBER BAMBOO grows in a collection at the Plant Introduction Station, Savannah, Ga. Fast-growing culms reach full diameter (5 inches) when a few inches tall, and full height (70 feet) in 6 or 8 weeks. Thirty-seven species (only 2 native) grow commercially here. They do best where minimum winter temperature ranges 5° to 25° F.

BAMBOO

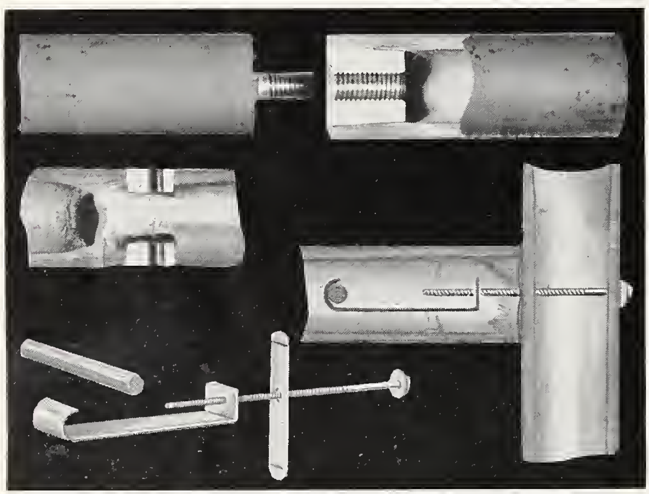
. . . grass of many uses

BAMBOO, fast-growing grass of a thousand uses, may be just the crop for some of the southern coastal plain's relatively unproductive land.

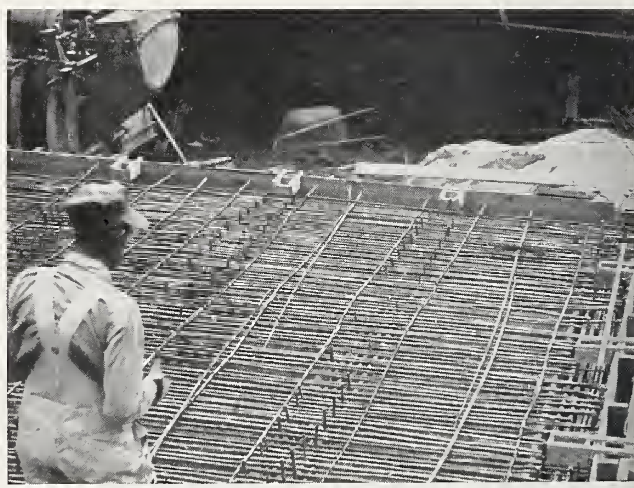
A number of desirable bamboo species will grow in this country along a section of the coastal plain extending from southeast Virginia to southeast Texas. These bamboos favor some freezing temperatures, but not under 5° F. Thirty-seven species are now being grow in the South, mostly in small groves, for economic use.

The USDA-ARS Plant Introduction Station at Savannah, Ga., and three cooperating research organizations are evaluating the bamboo species that are climatically adapted to the Southeast as to uses for the crop. And they are sizing up the market potential for each purpose.

Bamboo is already being used in making such diverse products as furniture, fishing poles, flag poles, boat masts, garden and orchard poles and stakes, radio antenna poles, ladders, trellises, and decorative fences—most of them relatively minor outlets. As a result of surveys of bamboo's market potential, made under contract for ARS,



NEW JOINING DEVICES make strong furniture, ladders, sporting equipment, other bamboo products. Joints in three top pictures use threaded aluminum plugs, thinly coated with plastic adhesive and welded electronically in a precisely reamed bamboo. Hook-and-nut union below was devised by USDA Foreign Agricultural Service.



BAMBOO REINFORCEMENT may strengthen light concrete 2 or 3 fold, the Clemson Engineering Experiment Station found. There's a potential use for it in light concrete structures on farms. Concrete's strongest with bamboo 3 or 4 percent of concrete bulk. Tension, flexure, compression tests may reveal other structural use.

engineers of the Georgia Institute of Technology have recommended conducting a thorough study of the economic possibilities of bamboo for paper pulp. The Chinese have made paper from bamboo for centuries.

The rather high average yield—8 or 9 tons per acre per year—of the timber bamboo *Phylostachys bambusoides* at the Savannah station is impressive. The engineers recommend sizeable plantings of suitable species for pilot-plant study of both production and pulping, as well as study of bamboo's physical properties in relation to curing and processing methods.

The nonprofit Herty Foundation at Savannah, Ga., demonstrated that high-grade paper and newsprint can be made from bamboo. Under research contract with ARS, the foundation is studying fiber length and pulping properties of species at the Plant Introduction Station.

The Clemson College Engineering Experiment Station, also under contract with ARS, is studying the potential uses of bamboo in construction. That station demonstrated the effectiveness of bamboo reinforcing in light concrete structures and is studying physical characteristics of the plant as a guide to additional new uses.

New hardware designs for fastening the poles together should improve the quality of bamboo furniture, ladders, trellises, and fences and afford a larger market where one already exists. The domestic food trade's demand for bamboo sprouts ranges up to $500,000 a year.

In the long run, however, the South's opportunity to capture any of these markets depends on its ability to compete successfully with off-shore suppliers. ☆

BAMBOO SHOOTS, a palatable staple food in the Orient, might find $500,000-a-year market for oriental cookery in large American cities. Market potential for other products—furniture, ladders, decorative fences, and trellises, to mention a few—is covered in a broad study by ARS of economic opportunities for growing bamboo.

NEW TREATMENT to destroy grubs saves time, labor, equipment. Oversized hypodermic needle injects insecticidal solution into soil balls. Liquid evaporates into insect-killing gas that fumigates soil around plant roots. Soil temperature must be 45° F. or higher during treatment and following a 3-day holding period.

SHOOTING TO KILL

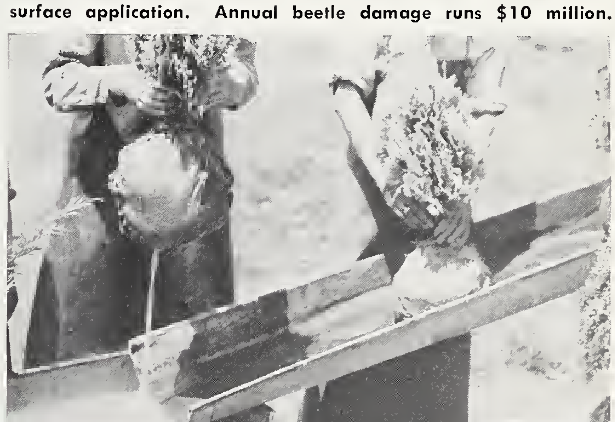
Japanese beetle grubs

Getting rid of Japanese beetle grubs in balled nursery stock is cheaper and easier with insecticide injections recently developed by ARS and cooperating State regulatory officials and commercial nurseries.

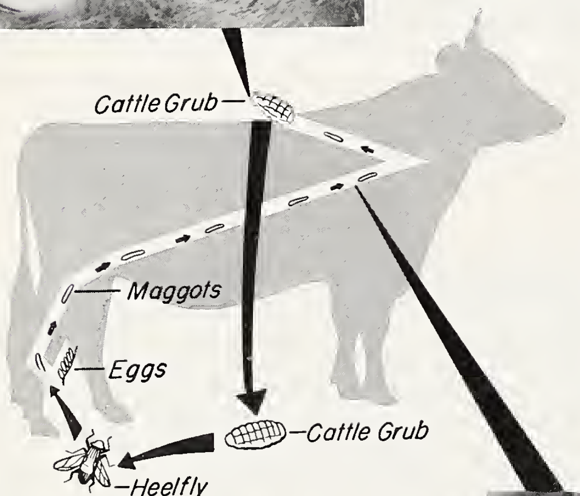
The treatment consists of "shooting" an ethylene dibromide solution into the soil around plant roots. Plant quarantine inspectors must be present during injections, as with other authorized treatments.

Treated plants are certified as safe for shipment or sale outside areas under U. S. Japanese beetle quarantine regulation. Thirteen eastern States, Ohio, and the District of Columbia are quarantined. ☆

OTHER TREATMENTS include messy dipping (below), fumigation, surface application. Annual beetle damage runs $10 million.



GETTING AT Grubs FROM THE INSIDE



INSECTICIDE is injected into a yearling by veterinarian G. T. Woodard—part of scientists search for a systemic treatment to kill cattle grubs *before* they cut production of meat or milk or damage an animal's hide. One of these culprits is caught in the act of emerging (top), having completed growth in the back. Grubs drop to ground, change to heel flies, which lay their eggs on heel and belly hairs of cattle during the spring. Small maggots hatch and bore through skin to begin a 9-month trip up through animal's body to neck region and on up to the back.

CATTLE grubs have been killed in the backs of cattle by feeding or injecting small amounts of organic *phosphate* insecticides, USDA-ARS scientists report.

These toxic chemicals are carried by the bloodstream to all parts of the body. Cattle grubs developing in the animal soon die after dosing themselves with insecticide.

This success with phosphorus chemicals, which have relatively *short toxic lives*, marks another advance toward systemic control of livestock insect pests. Chemicals used were diazinon, chlorthion, and a dialkyl phosphate (0, 0-dimethyl-2,2,2,-trichloro, 1 hydroxy ethyl phosphonate).

A year ago, entomologists W. S. McGregor and R. C. Bushland and veterinarian R. D. Radeleff, working at the ARS Kerrville (Tex.) laboratory, announced they had killed cattle grubs by injecting animals with aldrin, dieldrin, and lindane (AGR. RES., Mar.–Apr. 1953). These are insecticides of the organic chlorinated hydrocarbon type.

The three shorter-lived phosphorus materials proved equally effective. So the scientists not only have broadened the field of potential systemic materials but also may have moved a step closer practical cattle grub control.

With a proven phosphate insecticide, a stockman could presumably treat his animals at the most opportune time, get a fast kill of the grubs, and not run the risk of toxic residues of the insecticides appearing in the milk or meat.

Proving out this idea is only one of the problems facing the researchers. They must also learn: (1) if systemic treatment will destroy cattle grubs *before* they damage the hide, or before extensive feeding at the host's expense (in the most recent tests, the grubs completed their growth and pierced the animals' backs before dying); (2) if continued use of these materials will have a toxic effect on livestock; (3) what are safe, effective, economical dosages of different insecticides for different breeds, ages, and sexes of cattle.

At present, of course, the scientists don't recommend the systemics. There's still a lot of work to do. But success will make the effort worthwhile. Cattle grubs cost millions of dollars a year in meat, milk, and leather. ☆

THERE'S SOMETHING IN THE AIR

THE AIR they breathe is probably the most important part of poultry environment from the time chicks are started till they are sold as broilers or old hens.

So say USDA–ARS agricultural engineer W. A. Junnila and Extension poultryman W. A. Aho, collaborating in poultry house ventilation research at the University of Connecticut.

Ventilation and insulation go hand in hand in keeping air at the right temperature and humidity.

Today, thousands of chicks are brooded at once, often in houses of 2 or 3 stories. This takes fuel. To cut costs, poultrymen have sealed houses (laying houses, too) tighter and tighter. Tight sealing has brought with it less air movement and more water vapor—and aggravated the wet-litter problem. These conditions have favored development of ammonia blindness, coccidiosis, and respiratory and other diseases. Most growers don't ventilate enough. And there's no substitute for ventilation, even if it causes higher brooding and insulation costs.

Around-the-clock control of air conditions can be obtained with fans. They exhaust the foul air, replenish it with fresh outside air. Moisture moves out as warm air is replaced by cool, and ammonia goes too. Fans used to exhaust air in winter can be turned around to blow air in directly at the birds for summer.

The last two winters, Junnila and Aho have replaced some poultry-house windows with fiber-glass insulation (see illustration). It's just an improvement on long-used sacking.

Moist air, you see, is a mixture of air and relatively *independent* water vapor. Sacking and fiber glass are partial *air* barriers—yet, *water vapor* passes through easily. Since there's always more water vapor *inside* than outside a poultry house in winter, moisture naturally moves out through the sacking or insulating material. But little of the warm air is lost.

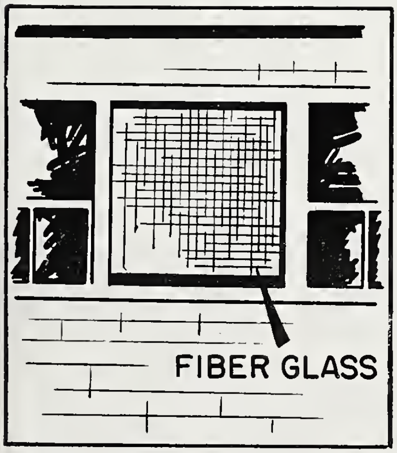
Unfortunately, this moisture movement isn't restricted to windows. It passes through most building materials, causing condensation on cold surfaces and deterioration of the materials (see illustrations).

In a house 30 to 36 feet wide, attic louvres will provide the air that's necessary around the *outside* of the insulating material. Ridge ventilators or fans may work better in wider buildings that have gable roofs.

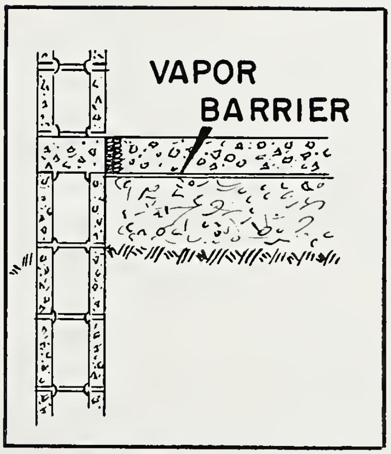
A flock may need 2 to 3 cubic feet of air per minute per bird in winter to remove ammonia and moisture. Fans should be picked accordingly. The rate may have to be cut to avoid freeze-ups if a house isn't built for it.

Junnila and Aho warn that if the gravity system of ventilation doesn't work, fans probably won't improve it enough, except in a wide house. The first need is more insulation.

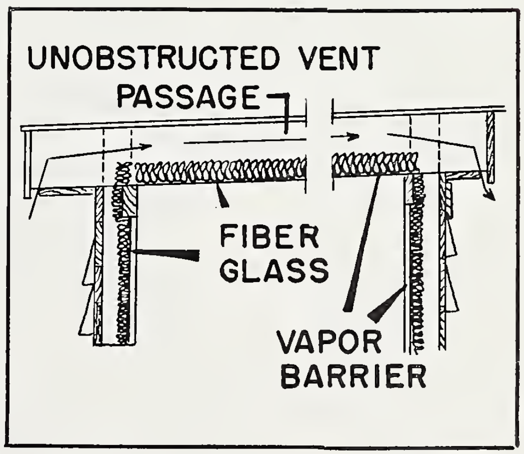
But in proper combination, insulation and ventilation will pay off. ☆



WINDOW with fiber-glass insulation lets moisture leave, keeps in much of heat. Window-size frame holds insulation sandwiched between layers of poultry netting. This replaces from 30 to 40 percent of windows for the winter.



FLOOR is protected against much movement of moisture from ground by using a layer of heavy bituminous felt or metallic foil. Vapor has a tendency to flow upward from the soil when litter temperature drops below ground temperature.



WALL, CEILING need supplemental vapor barrier (metallic foil, glossy asphalt paper, layered paper with felt between) on insulation's warm side. Fiber-glass bats, supported by wire mesh fine enough to keep out rats, works for ceiling insulation. Air must be provided to the outside of this insulation.

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AGRISEARCH Notes

LOW: corn protein v. weather

Protein content of corn as a whole is strongly influenced by climatic conditions, especially temperature.

This finding by USDA–ARS chemist F. R. Earle at the Northern Regional Research Laboratory is based on a study of the records of six midwestern corn-processing companies covering the period from 1907 to 1952.

Current shortages of proteins, especially for feeds, make corn's protein content increasingly important.

These research results indicate that the decline in protein content since the mid-thirties—from about 11 percent (dry basis) to under 10 on the average—is due to lower maximum summer temperatures and not to increased use of new hybrids, as some observers believed.

Differences in temperature seem to have a greater effect on the protein content than variations in rainfall.

Further research is needed to determine the exact relation between protein content and climatic conditions, as well as to assess the importance of the many other factors that may affect corn's protein content. ☆

HIGH: heat damages wheat

High temperatures during the 15-day period just preceding wheat's ripening in the south and central Great Plains will damage protein quality in the normally-superior, high-protein hard red winter wheat.

Heat does much harm, differing by variety, when daily excesses over 90° total 50° or 60°—slight damage when totaling 20°. Dry temperature, dry soil accent damage. Protein *quantity* stays up; baking *quality* goes down.

Scientists of USDA–ARS and cooperating Great Plains experiment stations, who made the discovery, think the protein and carbohydrate enzyme systems in the grain's endosperm (nutrient storage tissue) are upset. ☆

RETURNS: from insect control

Chemical insect control in cotton adds up to about a fourth larger crop on the average.

Results of field trials for more than 30 years by USDA–ARS entomologists at Tallulah, La., show an annual average seed-cotton yield of 1,826 pounds per acre from treated plots. This is an increase of 371 pounds or 25.5 percent more cotton than from untreated plots, which averaged 1,445 pounds per acre.

Though percentage of increase has varied with the use of insecticides, *more* cotton has *always* been produced. In 1924, the increase amounted to only 1.1 percent. But production was boosted 112 percent in 1950, a year when boll weevils alone took nearly a quarter of our cotton crop. In 1951, the increase was 85.3 percent; 1952, 18.4 percent; and last year, 19.7 percent.

In all years entomologists have compared several plots to reduce the chance of unrealistic production averages. Altogether records have been taken from 973 plots. ☆

SAVINGS: with lime concentrates

A new 35-fold *unsweetened* lime-juice "superconcentrate" is the result of recent research at the USDA–ARS Citrus Products Station, Winter Haven, Fla. The station had previously developed a *sweetened* 8-fold concentrate and an *unsweetened* 16-fold concentrate.

Outstanding advantage of these products is a saving in space and transportation costs, without flavor loss.

Unsweetened 35-fold lime superconcentrate is made by concentrating about 12 volumes of fresh juice to 2 volumes, adding 1 volume of lime puree, and freezing. Limeade is prepared by adding about 4 pounds of sugar to 1 pint of concentrate and diluting to 4⅜ gallons.

Equipment for making lime-juice products is on hand in orange-concentrate plants. Since limes are available when this equipment is normally idle, production of concentrates would extend the processing season, increase equipment use, and provide work at a slack time. ☆

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